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NOTES ON THE FOSSILS FROM THE KANSAS-OKLAHOMA RED-BEDS

THE age of the series of rocks lying conformably on the Permian and unconformably below the Comanche Cretaceous in Kansas and Oklahoma has for a number of years been considered problematic. The earlier Kansas geologists classified these formations anywhere between the Carboniferous and the Middle Cretaceous. Later investigators have agreed that the series is not older than the Permian, nor more recent than the Jurassic. In Texas, rocks which appear to be of the same age are assigned to the Permian on the authority of such paleontologists as Cope and White.¹

In the absence of certain determination as to age, the general term Red-beds has been applied to these formations in Kansas and Oklahoma. The term refers to the lithological appearance of the rocks. Blood red sandstones, clays, and shales make up the greater part of the thickness of the series. The shales are frequently strongly impregnated with mineral salts, of which gypsum and common salt form the larger part, although borax, magnesia, and others are not infrequent. These salts impart to the water of a great part of the area a characteristic taste, often rendering it unfit for use. In the central part of the Red-beds areas several ledges of massive gypsum occur. These ledges outcropping to the east form the escarpments and caps of the noted Gypsum hills which extend south from southern Kansas to the Wichita Mountains, and thence into central Texas. Ledges of dolomite and highly saliferous shales are found in many horizons of the Red-beds.

There is not lacking literature on the Red-beds. Some of the most noted geologists and paleontologists of America have written concerning these rocks. Such men as Cope, Hill, Williston, Haworth, Hay, Vaughan, Ward, Beede, Stevenson, and others

¹ Second Annual Report Geological Survey of Texas, 1890, pp. 415-419.

have contributed to our knowledge of the subject. The most comprehensive articles, however, are by Prosser and Cragin. Professor Cragin, in addition to incidental mention of the Red-beds in numerous papers on the geology of southern Kansas, has written two articles dealing exclusively with these series of rocks. In the first paper, entitled "The Permian Series in Kansas,"¹ the Red-beds are classified as Upper Permian, and are included under the Cimarron series, which is divided into two divisions, the Salt Fork and Kiger. Each of these divisions is further subdivided on purely lithological grounds into five formations. Professor Cragin's second paper, "Observations on the Cimarron Series,"² is little more than a revision of the former one. The grouping of formations and sub-formations is slightly changed, and a few new points added. These two papers contain the best description of the Red-beds extant. Professor Prosser's paper on "The Cimarron Series, or the Red-Beds,"³ contains the best historical review of the literature of the subject so far published, as well as an excellent description of the Kansas Red-beds.

The reasons for assigning the Kansas-Oklahoma Red-beds to the Permian were chiefly two, viz., first, these rocks were considered to be of the same age as the Texas Red-beds, which are recognized as Permian; and, second, the series grades conformably upward from rocks of undoubted Permian age. The fact that so far as known not a single fossil has been found in the Kansas Red-beds has always been the great obstacle to the accurate correlation of the series. During the past two years, however, as the result of both private investigation and of the work of the Oklahoma geological survey at least four localities have been discovered in the Oklahoma Red-beds from which fossils have been identified. These localities, with the character of the fossils contained in them, are as follows:

1. McCann's quarry, five miles southeast of Nardin, Kay county; vertebrates, invertebrates, and leaves.

¹ Colorado College Studies, March 1896, Vol. VI, pp. 1-48.

² American Geologist, May 1897, Vol. XIX, No. 5, pp. 351-363.

³ University Geological Survey of Kansas, 1897, Vol. II, pp. 75-95.

2. Two miles northeast of Orlando, numerous vertebrates.
3. Cedar Hill and Bitter Creek, northeast of Watonga; invertebrates.
4. Whitehorse Spring, sixteen miles west of Alva; numerous invertebrates.

Of these localities those numbered 1 and 2 are from the lower part of the Red-beds, not far from the base of the Harper sandstone. The fossils from locality numbered 3 were taken from ledges of sandy dolomite immediately beneath the heavy ledges of gypsum found near the middle of the Red-beds. Locality numbered 4 is from the Red Bluff sandstone in the upper part of the series.

A large vertebrate from McCann's quarry, or locality 1, was identified by Dr. S. W. Williston as *Eryops megacephalous* Cope, a form characteristic of the Permian of Texas. The invertebrates from the same locality were sent to T. Rupert Jones, who classified them as *Estheria minuta*, a Triassic form. The plants were shown to Dr. Lester F. Ward, who said that the forms seemed to resemble Mesozoic rather than Paleozoic types. From the Orlando locality Dr. Williston has identified the following forms: *Diplocaulus magnicornis* Cope; *Diadectidæ* Gen. indt.; *Pariotichus incisivorus* (?) Cope; *Labyrinthodont*; and *Trimerorhachis*; all of which he recognizes as Permian forms. From the locality numbered 3 but one species has been found. This is an invertebrate which here occurs in great numbers, and has been referred by Dr. J. W. Beede with some doubt to the Permian form *Sedgwickia*. The Whitehorse locality has yielded some twenty species of invertebrates, several of which are of new forms.

This locality is from the upper part of the Red-beds, or to be more exact from Cragin's Red Bluff sandstone perhaps 150 feet above the Medicine Lodge gypsum. The following genera are represented: *Conocardium*, *Aviculopecten*, *Schizodus*, *Pleurophorus*, *Bakevalia*, *Naticipsis*, *Pleurotomaria*, *Orthonema* and *Murchisonia*. One form that was at first thought to be *Jagmayeria*, a shell of Triassic age, has since been identified as *Dielasma*, very

like *D. biplex* described by Waagen from the Permo-Carboniferous of India.

Unfortunately no Cephalapods have as yet been found in the locality and until this is done the question of the exact age of the beds may scarcely be decided. The facts at command lead to the inference that the Whitehorse Springs locality is well up toward the close of the Paleozoic

CHARLES NEWTON GOULD.

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